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(54) Insecticide or aromatic substance vaporizer

(57) A vaporiser for insecticide or atomatic substances consists of a housing (1) having vents (2) through which a vaporisable substance carried by a belt (3) is discharged as a belt (3) passes at a controlled rate over a heating means (7) which causes the substance to vaporise. The belt (3) is driven at a fixed speed by a motor (12) driving a feed means (8) through a reduction gear (13) and the used belt (3) is rolled up on a take-up shaft or spool (5,6) which is driven from the belt feeding means (8) by a slipping drive belt (15) and a pulley (16) engagable with the take-up shaft (5). In a modified embodiment, the treated belt (3) is contained in a casing or cassette (23) having an opening (27) through which the belt can be fed to be passed over the heating means (7) and the driving means (8).

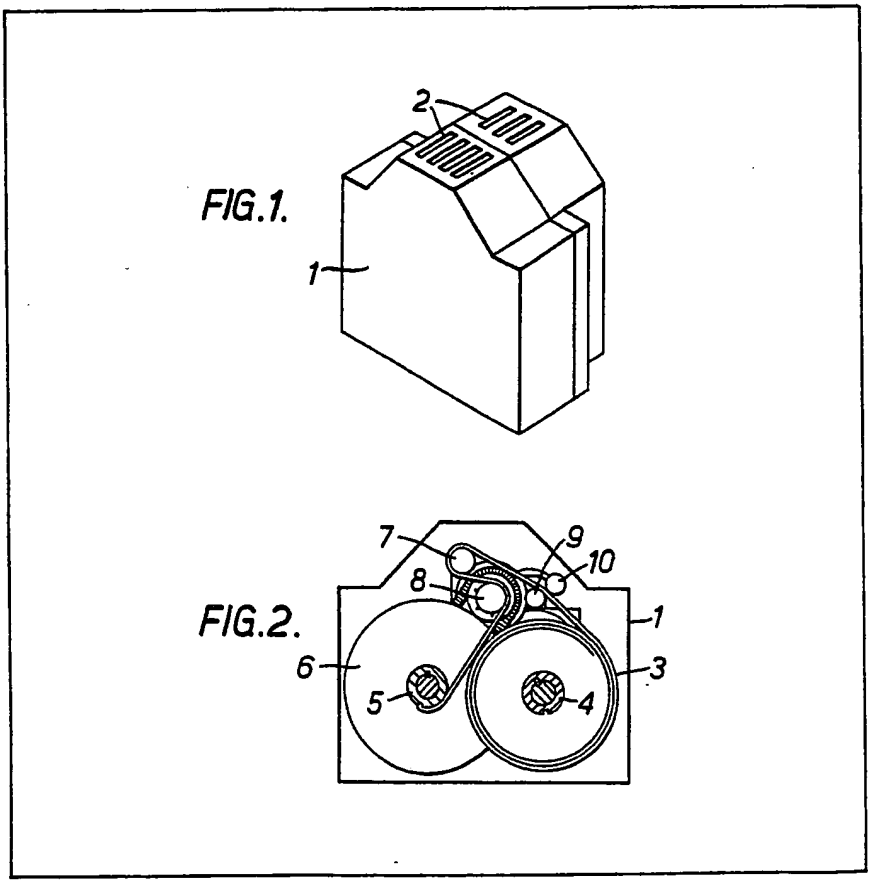

FIG.1.

FIG.2.

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FIG.1.

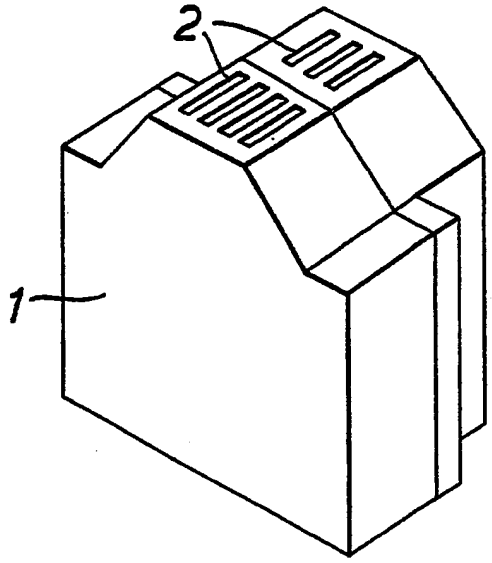

FIG.2.

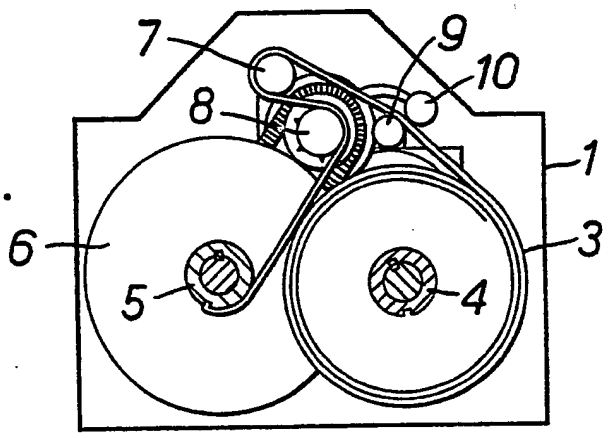

FIG.3.

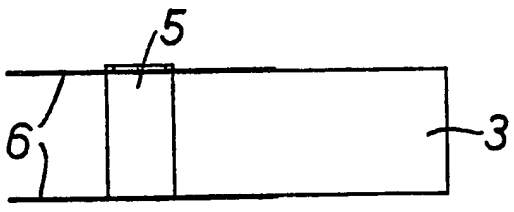

FIG. 7.

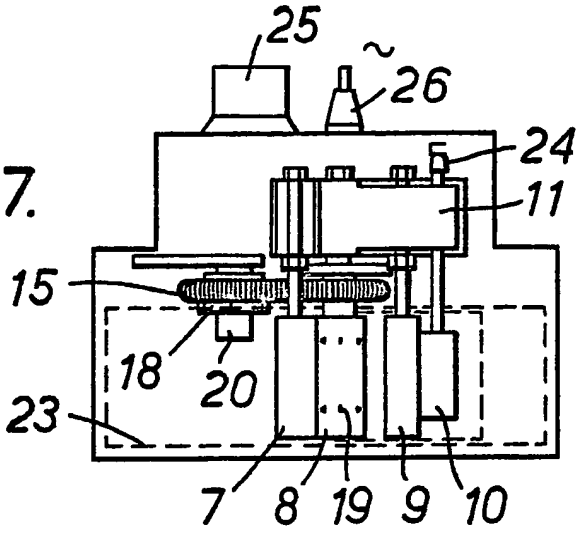

FIG. 8.

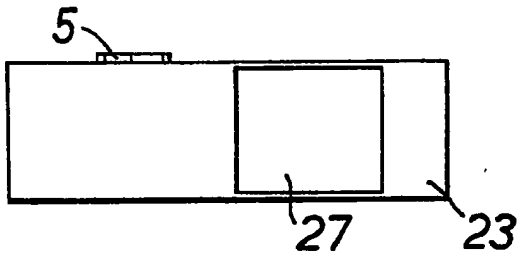

FIG. 9.

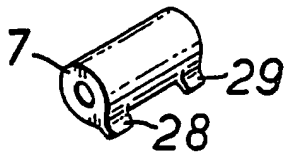

FIG. 10.

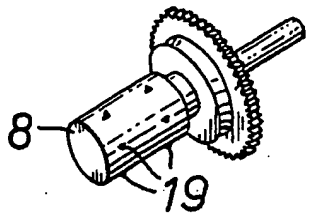

FIG. 11.

SPECIFICATION

A vaporiser, for example for insecticide or aromatic substance

The present invention relates to a heat-activated vaporiser which is intended to maintain the effect of, for example, a vaporisable insecticide or an aromatic substance which provides for not only safe and easy handling of the vaporisable substance, but also enables a controlled rate and extended period of vaporisation.

In many parts of the world, such as South East Asia, any pests such as mosquitoes and flies are not only troublesome but are also harmful to man and beast alike, throughout the year and to combat such pests, insecticide devices such as atomisers, incense fumigators with exothermic means and heating vaporisers employing a mat impregnated with an insecticide are known. All of these devices, however, have only a partial and transitory effect and, particularly in the case of incense burning devices, there is a further danger attendant on the process of ignition.

Fumigation devices tend to provide a rapid and temporary impregnation of a space, such as a room, with a large concentration of the toxic substance which demands the evacuation of the space during its operation. Furthermore, vapours which heat an impregnated mat or pad in which the mat or pad is placed on a heated surface are claimed to be effective for an area of up to 13 square metres over 10 to 12 hours, but in practice the efficiency of the substance being vaporised falls off in about half of this time with a corresponding loss of effect.

According to the invention, there is provided a vaporiser comprising a belt made of heat-resistant fibrous material to which a vaporisable substance is applied or which is impregnated with said substance, said belt being initially wound into a roll and one end of which is adapted to be attached to a take-up shaft or spool, the vaporiser including an electrical resistance heating means and a belt feeding means located in the path of travel of the belt, together with a slipping drive connection between the belt feeding means and the take-up shaft or spool, the vaporiser also having means for feeding the belt at a predetermined rate over the heating means whereby the substance which is applied to the belt or with which the belt is impregnated is heated for vaporisation.

A vaporiser constructed in accordance with this invention enables an impregnated mat to be replaced by a length of a belt which is impregnated with the vaporisable substance, or to which the substance is applied and which is passed over the heating means at a controllable speed typically of only a few millimetres per hour. As the slowly moving belt passes over the heater, the substance with which it is heated is vaporised continuously and effectively, at a rate which can be adapted to the volume of the space in which the vaporiser is to be operated.

The vaporiser is so constructed that it provides for safe and sanitary handling of the treated belt which initially is rolled up and which is taken up by the take-up shaft or spool as the vaporisable substance is consumed. The need to replace an exhausted mat or pad with a new one is eliminated and the working life of the belt depends on its length and the speed with which it passes over the heating means.

Typically it has been shown that a belt of about 3 metres in length may have a working life of more than 30 days of continuous use; if a time switch is used, the period of use can be considerably extended.

Although primarily for use with insecticides, the vaporiser of this invention can also be used for vaporisable aromatic substances, which are increasingly used in automobiles and buildings, for example in kitchens and toilets to counter undesirable odours. Generally such substances are discharged at normal temperatures and are influenced by such factors as humidity and air flow, which makes it difficult to achieve vaporisation at a constant concentration and rate. The present invention enables a controlled vaporisation to be obtained so that the rate of discharge is kept constant and uniform over a prolonged period without risk of leakage or spillage.

Preferably, the belt, which is made of a soft and heat resistant fibre, is rolled up after being treated with the vaporisable substance and its leading end is adapted to be attached to a take-up shaft or spool after the unused belt is loaded into the vaporiser and its free end passed over the heating means and the belt driving or feeding means. The take-up shaft and spool is inter-connected with the belt feed drive means by a slipping drive belt passing over a sleeve or pulley, by means of which the take-up shaft spool is rotated in synchronism with the rate at which the belt passes over the heating means.

The treated belt passes at the chosen speed over the electrical heater while the heater is heated by the supply of electrical power, the belt feed driving means being rotated at the appropriate speed and the used part of the belt is wound upon the take-up shaft or spool.

Preferably the belt feed driving means includes an electrical motor and incorporates a reduction gear in order to obtain the desired speed of travel for the belt.

In a modified embodiment of the invention instead of the belt being in the form of a roll placed on a shaft and one end of which is taken up by the take-up shaft or spool, the belt can be contained in a casing or cassette, having an opening through which a loop of the belt can be brought out and passed over the heating means and the belt driving means. Such a construction greatly simplifies the installation and removal of the belt.

An embodiment of the invention will now be described by way of an example and with reference to the accompanying drawings, in which:–

Figure 1 is a perspective view of a vaporiser in accordance with the invention,

Figure 2 is a side elevation of the vaporiser with the side wall removed,

Figure 3 is a plan view of the take-up spool with the associated end of the belt,

Figure 4 is a side elevation of the vaporiser similar

to Figure 2 but with the belt and its spool removed,

Figure 5 is an end elevation of the left hand end of the vaporiser shown in Figure 4,

Figure 6 is a side view of the vaporiser similar to that of Figure 4 but with the belt contained in a casing or cassette,

Figure 7 is a plan view of the devices shown in Figure 6 with the belt and its casing removed,

Figure 8 is a plan view of the belt cassette of Figure 6 and

Figures 9, 10 and 11 are perspective views respectively of the heating means, the belt feeding drive wheel and the driving pulley of the take-up spool or shaft.

Referring now to the embodiment shown in the drawings, Figure 1 shows a perspective view of a housing 1, in which the device on which the invention is based is contained; the housing 1 has an arrangement of vents 2 from which a vaporisable substance can be diffused to the exterior. Figure 2 is a front view of the housing shown in Figure 1 with the side wall removed. As can be seen, the device consists of a vaporising belt 3, a shaft 4 round which the belt is wound; a take-up spool 5 with a side plate 6 on its rear side, (the side plate on its nearer side being not shown); an electric resistance heater 7 coated with enamel; a belt feed driving wheel 8 to which the rotation is transmitted from a Warren-type synchronous motor 12; a guide roll 9 for the belt 3; a a counter roll 10 for the belt, the belt passing between these rolls 9 and 10; and a supporting rod 11, supporting the counter roll 10 as a fulcrum, the other part of which is slidably coupled with a shaft of a driving wheel. Fig. 3 is a plan view of the state in which the take-up spool and the turns of belt, illustrated in Fig. 2 are combined with each other and the inside end part of the reel shaft makes a shallow notched protrusion. Fig. 4 is a side view illustrating the interior of the device with the belt and the spools taken off, a Warren-type synchronous motor 12 is rotated at a very slow speed; and 13 is a transmission by which the driving wheel is adapted to be rotated at 1/720 rpm, namely by one turn per 12 hours by means of pinion gear mounted on the Warren-type synchronous motor 12; 14 is an arrangement by which a time less than 12 hours can be continuously set by a motor type of time switch, thereby controlling the heater 7 and the Warren-type synchronous motor 12; 15 is a driving belt, made of a coil spring, which transmits partially a rotation of the driving wheel 8 to a pulley 16; 17 is a supporting projecting shaft with which the shaft 4 of the vaporising belt 3 is slidably coupled; 18 is a notched annular projection on the side face of the pulley-block, which is engaged with a correspondingly notched projection on the end face of the winding or take-up shaft 5 so that they are engageable with each other. The outer circumference of the driving wheel 8 is provided with projections 19, which transmit the rotation of the driving wheel to the belt 3; since 6 rows of projections 19 are inserted on the outer circumference of the driving wheel, the pitch is set to 7 millimetre, the belt 3 may have similarly spaced perforations which co-operate with the lugs of the driving wheel set to 7 millimetres, for a better drive effect. If the belt 3 is unperforated the lugs 19 are pointed in order to penetrate into the belt. Fig. 5 is an end view of the principal part of the device; a shaft 20 is provided along which the pulley 16 slides, the hole of the reel shaft also being slidably coupled therewith; 21 is an abutment, opposite to the shaft 20, which is provided in the inside of the housing being slidably coupled with the hole of the belt shaft 4. Fig. 6 is a front view of the inside of the device, with the cover wall of a cassette removed, in which cassette the turns of the belt 3, the winding shaft 4, and the take-up spool shaft 5 are incorporated; 23 is the cassette casing, which is equipped with holes on both its side faces, supporting the winding shaft 4 and the take-up shaft 5. Fig. 7 is a plan view of Fig. 6, with the belt 3 removed; an electric contact 24 is placed on the shaft end of the counter roll for the belt 10, which is adapted to de-energize the heater 7, the Warren-type synchronous motor 12, and the motor-type of time switch 14 by switching off the power, when the tail end of belt 3 passes between the rolls 9 and 10, so that the roll 10, making the shaft of the driving wheel 8 serve as a fulcrum, falls, tracing a circular path which sets its radius to a "supporting rod" length; 25 is a time setting dial for the time switch 14; 26 is a power inlet; and the part confined by a dotted line in Fig. 7 is the cassette in which a projecting part of the take-up shaft 5 makes a protrusion from the side face thereof; 27 is an upper opening of the cassette, from which a loop of the belt is drawn out so that it is hung on the heater 7 and the driving wheel 8. Fig. 9 is a perspective view of the heater 7, which is equipped with terminals 28 and 29 at both of its ends. Fig. 10 is a perspective view of the driving wheel. Fig. 11 is a perspective view of the pulley-block 16.

In the above mentioned embodiment, provided that a diameter of the rolls of belt is for example 8 centimetres, the diameter of the shaft around which the belt is rolled up is 1.8 centimetres, the width of the belt is 3.5 centimetres, and the thickness of the belt is 0.15 centimetres, then the length of the belt is given by:–

$$\pi \times \{(9\ \text{cm})^2 - (1.8\ \text{cm})^2\} \times (1/2)^2 \div 0.15\ \text{cm} = 318\ \text{cm}.$$

The volume of the above belt is found by

$$318\ \text{cm} \times 3.5\ \text{cm} \times 0.15\ \text{cm} = 167\ \text{cm}^3$$

The moving distance by one rotation of the belt feed driving wheel:–

$$6 \times 0.7\ \text{cm} = 4.2\ \text{cm}.$$

Then, if a rotational frequency of the driving wheel is 1/720 RPM, the moving distance of the belt for one day, i.e. 24 hours:

$$4.2\ \text{cm} \times 1/720 \times 60\ \text{mm} \times 24 = 8.4\ \text{cm}.$$

Since the length of the belt is 318 cm, when performing the actuation under the continuous supply of power, the maximum vaporising time:

$$318\ \text{cm} - 8.4\ \text{cm} = 38;$$

that is, a 38 day vaporisation can be continuously performed. Furthermore, in case of actuation for 8 hours per day:

$$38 \times 24/8 = 114,$$

resulting in 114 days, that is, a maximum period of use per roll of belt may reach approximately 4

months. Provided that the heating vaporisation is completely performed, when an application and impregnation rate of the drug solution to belt volume is 30%, the vaporisation quantity per day is calculated to be:

8.4 cm × 3.5 × 0.15 cm × 30/100 = 1.32 cml;

that is, the vaporised quantity per day is 1.32 cc. When the application and impregnation rate thereof is 40%,

8.4 cm × 3.5 × 0.15 cm × 40/100 = 1.76 cml;

that is, 1.76 cc of vaporisation quantity is obtained.

Mosquito catching mat, one of the insecticides marketed at the present, is made by several manufacturers. The vaporised component which is impregnated in one sheet of mat is approximately 0.2 cc or less, in which the insecticide – constituting volume is approximately 0.05 gram. Since the vaporisation effective time of the mat on sale is nominally 10-12 hours, a 24 hour operation requires 2 sheets of mat to be used. In that case,

0.2 cc × 2 = 0.4 cc;

that is, a day operation gives rise to 0.4 cc of vaporisation quantity. Since if compared with the embodiment of the present invention, the solution, the insecticide's concentration of which is equal to that presented by the impregnation component of the mat on sale, performs a 1.32 cc of vaporisation per day at 30% of the belt's impregnation rate,

1.32 cc ÷ 0.4 cc = 3.3;

that is, the vaporisation is increased by 3.3 times. If the belt's impregnation rate is 40%,

1.76 cc ÷ 0.4 cc = 4.4;

that is, the vaporisation is increased by 4.4 times. For this reason, the present vaporisation is effective in a larger space, being able to be used for longer periods, and eliminates the labour which the mat type of device requires in being handled, making possible a vaporisation under a uniform concentration.

A liquid type of aromatic atomizer marketed nominally says that the material containing 150 cc of perfume solution, which is diluted to about 8% by emulsifier, water or alcohol in order to promote the vaporisation, in a container continues to vaporise the aromatics for about 60 days. In that case, provided that this aromatics atomizer continues to vaporise a constant volume of solution every day, the vaporisation amount of the perfume per day is:

150 cc ÷ 60 × 8/100 = 0.2 cc.

The embodiment of the present invention, which can perform vaporisation regardless of any concentration due to the heated vaporisation, may obtain the below figure under the condition that a 50% concentration is impregnated in the belt at 30% of impregnation rate:

1.32 cc × 50/100 ÷ 0.2 cc = 3.3

that is, the concentration of the vaporised solution is 1/3.3. Furthermore, the installation and operation of a switch may permit the vaporisation to be freely controlled.

Thus, the present invention, when using a roll of belt impregnated with an insecticide or an aromatic can be continuously used for over one month or used for 4 months or less, provided that it is operated for 8 hours every one month by means of putting a time switch into actuation. More conveniently, since the life span of Warren-type synchronous motors which is used in the present embodiment, is estimated to be over 15,000 hours, that of the present device is:

15,000 H ÷ 24 H = 525,

or 525 days of continuous use, namely over 14 months, and, if it used for 8 hours per day, its life span is correspondingly increased to as long as 3½ years. In addition to this, the present device, which is equipped with a safety device designed to automatically turn off the power when the belt is used up, needs only a change of the belt of the cassette into which the belt is incorporated at such a time. For this reason, the present device is a vaporiser for insecticide or aromatics which minimise labour in handling and is operated safely and hygienically.

CLAIMS

1. A vaporiser comprising a belt made of heat resistant fibrous material to which a vaporisable substance is applied or which is impregnated with said substance, said belt being initially wound into a roll and one end of which is adapted to be attached to a take-up shaft or spool, the vaporiser including an electrical resistance heating means and a belt feeding means located in the path of travel of the belt, together with a slipping drive connection between the belt feeding means and the take-up shaft or spool, the vaporiser also having means for feeding the belt at a predetermined rate over the heating means whereby the substance which is applied to the belt or with which the belt is impregnated is heated for vaporisation.

2. A vaporiser according to claim 1 wherein the belt is contained in a casing having an opening through which the belt is guided to be fed over the belt feeding means and the heating means and returned to the take-up shaft or spool.

3. A vaporiser substantially as herein before described and with reference to Figures 1 to 5, and 9 to 11, or Figures 1 to 8 and 9 to 11, modified as shown in Figures 6 to 8, of the accompanying drawings.

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